

ASTROPHYSICS PROBE 2023
ANNOUNCEMENT OF OPPORTUNITY (AO)
LAUNCH SERVICE INFORMATION SUMMARY

NASA-Provided Launch Services Ground Rules/Policy

This document provides additional information for NASA-provided launch services. This launch service will be provided by NASA will be procured and managed by the NASA/Launch Services Program (LSP) using government contracts.

Under this AO, the Proposer may not arrange alternative access to space.

Under the provisions of the NASA Launch Services II (NLS II) contract, the launch service includes the Launch Vehicle (LV) and associated standard services, non-standard services (mission-unique options), all engineering and analysis, and minimum performance standards. LSP also provides technical management of the launch service, technical insight into the LV production/test, coordinates and approves mission-specific integration activities, provides mission unique LV hardware/software development, provides payload-processing accommodations, and manages the launch campaign/countdown.

At the appropriate time following mission selection, LSP will competitively select a launch service provider and award a launch service for the mission based on customer requirements. The launch service is awarded to the Contractor that provides the best value in launch services to meet the Government's requirements based on technical capability/risk, reasonableness of proposed price, and past performance. Accordingly, assumption of a specific launch vehicle configuration as part of the AO proposal will not guarantee that the proposed LV configuration will be selected unless there is firm technical rationale for sole source. Any such rationale should be clearly identified and explained in the proposal.

All NASA-procured launch services will be consistent with NASA Policy Directive (NPD) 8610.7D, NASA Launch Services Risk Mitigation Policy. Launch services acquired by NASA will be managed in accordance with NPD 8610.23C, Launch Vehicle Technical Oversight Policy, and NPD 8610.24C, Launch Services Program (LSP) Pre-Launch Readiness Reviews. These NPDs can be accessed through the AO library.

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Launch Vehicle Information/Configuration/Performance

For a NASA/LSP-provided launch service, the proposal must be designed to the enveloping launch vehicle characteristics, capabilities and environments provided in Attachment 1. Figures 1-3 depict representative nominal performance for high energy, sun-synchronous, and low-inclination orbits. Vehicle performance defined by the “Performance Upper” curves exceed the capability of a standard/intermediate class launch vehicle and are subject to the Cost Cap Adjustments defined in the AO (see Section 5.9.2.1). Vehicle injection dispersion capabilities will determine the accuracy of targeting these orbits. Attachment 1, Figures 4A and 4B depict the constraining payload fairing static envelopes that will ensure compatibility across a range of potential launch vehicles currently expected to be available under the Baseline and Performance Upper launch services.

Launch Service Costs

The Astrophysics Probe Program within the Science Mission Directorate will hold the launch service costs for any proposed mission requiring the baseline launch vehicle performance as defined in the Attachment 1 of this summary, defined by the Performance Baseline curves in Figures 1 and 2 and Standard Payload Fairing (PLF) volume (Figure 4A). Any proposals requiring additional launch vehicle performance (but not a larger payload fairing), defined by the Performance Upper – Std PLF curves in Figures 1, 2 and 3, will be subject to the \$50M Cost Cap Adjustment specified in the AO (see Section 5.9.2.1). The larger volume PLF defined in Figure 4B is only available with the Performance Upper – Large PLF vehicle shown in Figures 1, 2, and 3. Proposals requiring this category of vehicle will be subject to the \$65M total Cost Cap Adjustment specified in the Final AO (see Section 5.9.2.1).

Standard services provided in the launch service costs to be covered by the Astrophysics Probe Program are:

- the launch vehicle, engineering, analysis, and minimum performance standards and services provided by the NASA NLS II (or applicable follow-on) contract in place at the time of launch service acquisition
- mission integration;
- launch site payload processing;
- range safety support;
- down range telemetry support (launch vehicle only)
- nominal allocation for non-standard/mission unique launch vehicle modifications/services – items typically necessary to customize the basic vehicle hardware to meet spacecraft driven requirements (see Attachment 2 within this document).

The Astrophysics Probe launch service budget set aside does not include funding for PI/payload-caused launch delays.

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Evaluation Criteria

Attachment 3 shows a preliminary Risk Assessment checklist that will be used as a guide for the launch service evaluators during the proposal evaluation phase. This checklist should provide an indication of the types of information that are expected to be in the proposals (see AO Appendix B). If the proposal does not provide sufficient information, the launch vehicle section of the proposal may not be evaluated for full content and may be listed as a finding.

NASA Launch Services Program Point of Contact (POC) for Additional Information

Additional launch vehicle information including performance quotes for other orbits/destinations, mission integration inquiries, standard services, and non-standard/mission unique services costs may be obtained from the point of contact below.

John Calvert
Mission Manager
NASA Launch Services Program Code VA-C
Kennedy Space Center, FL 32899 Phone: 321-266-4835
Email: john.h.calvert@nasa.gov

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**Attachment 1
Launch Service Characteristics/Capabilities**

Performance Information:

Performance capabilities to a range of orbit altitudes/inclinations is available from multiple launch sites. Figure 1 depicts expected representative nominal performance to a common range of altitudes/inclinations (circular orbits). For mission specific information, utilize the LSP performance website and/or the point(s) of contact listed in this document. The LSP performance website may provide multiple vehicle solutions for a practical orbit, however not all vehicles are to be considered in this AO due to cost constraints. Please communicate with the point(s) of contact listed in this document for additional information.

Performance Ground Rules (valid for all scenarios):

- The LV performance available on NLS-II generally does not include impacts associated with orbital debris compliance; this must be evaluated on a mission- specific basis. Depending on LV design, this could result in a significant performance impact to ensure full compliance with orbital debris policy.
- Guidance reserves have been allocated to account for 3-sigma flight performance.
- Performance is for a Baseline or Upper LV configuration where noted (see Attachment 2). Other non-standard, mission-unique hardware will require additional assessment.
- The mass of a 47 inch (1194 mm) separation system is assumed and is accounted for on the launch vehicle side. Proposers wishing to use a different separation system should contact the POC in this document for information on potential performance and cost impacts.

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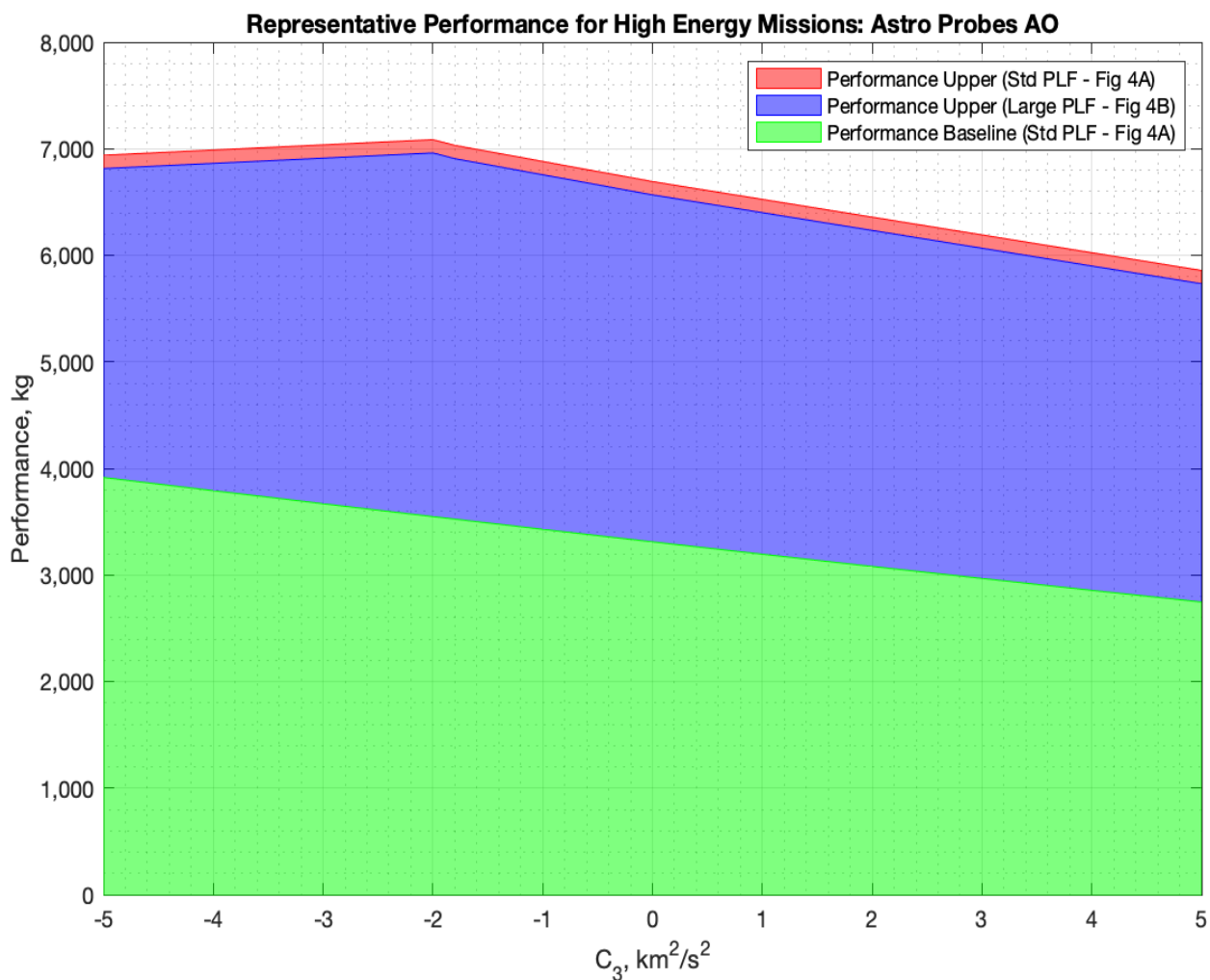


Figure 1: Constraining High Energy Performance Curves

C_3 , km^2/s^2	Baseline	Upper (Standard Fairing)	Upper (Large Fairing)
-5	3915 kg	6935 kg	6810 kg
-2	3545 kg	7085 kg	6960 kg
5	2745 kg	5855 kg	5730 kg

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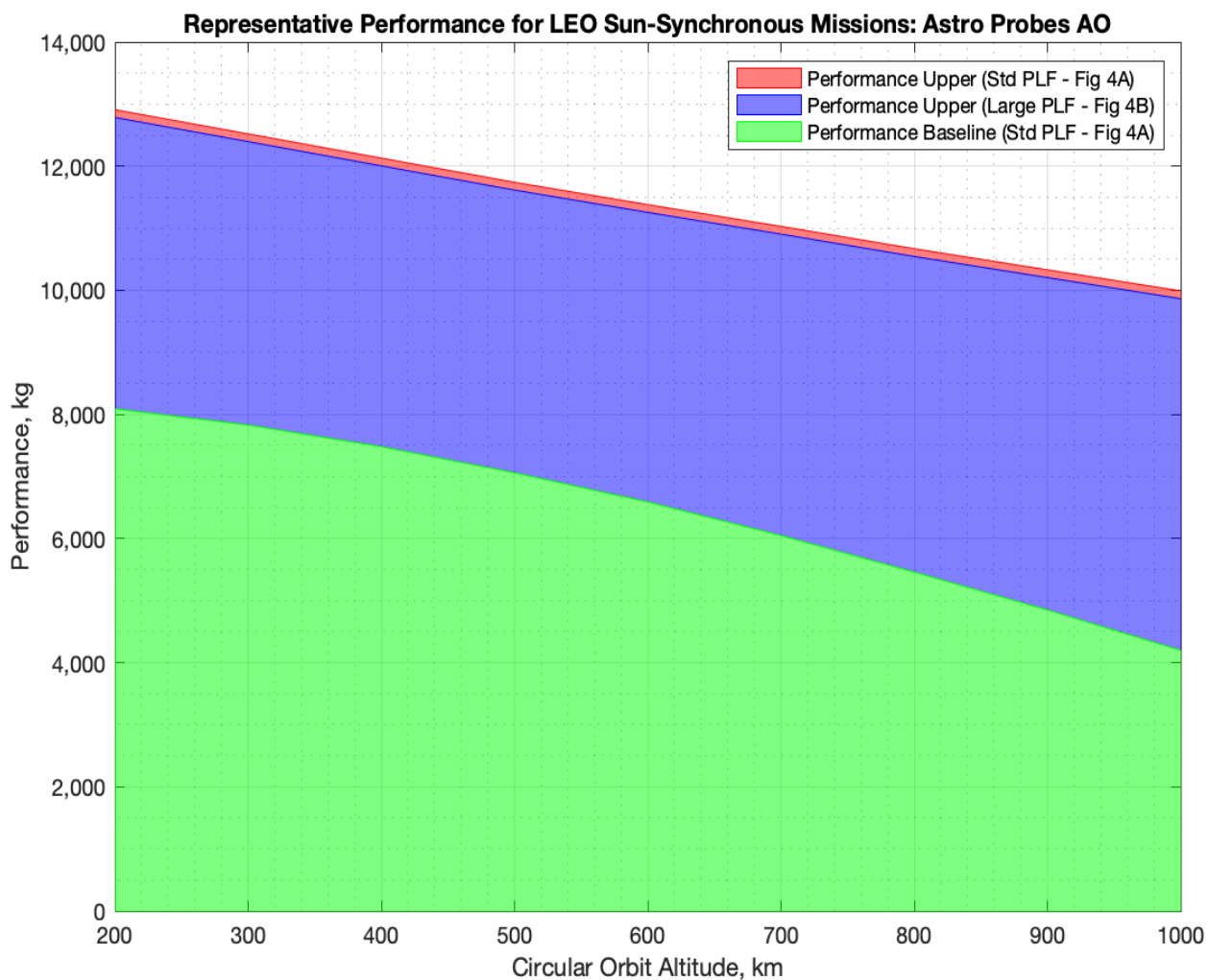


Figure 2: Constraining LEO Sun-Synch Performance Curves

Altitude, km	Baseline	Upper (Standard Fairing)	Upper (Larger Fairing)
200	8090 kg	12910 kg	12785 kg
600	6590 kg	11380 kg	11255 kg
1000	4200 kg	9990 kg	9865 kg

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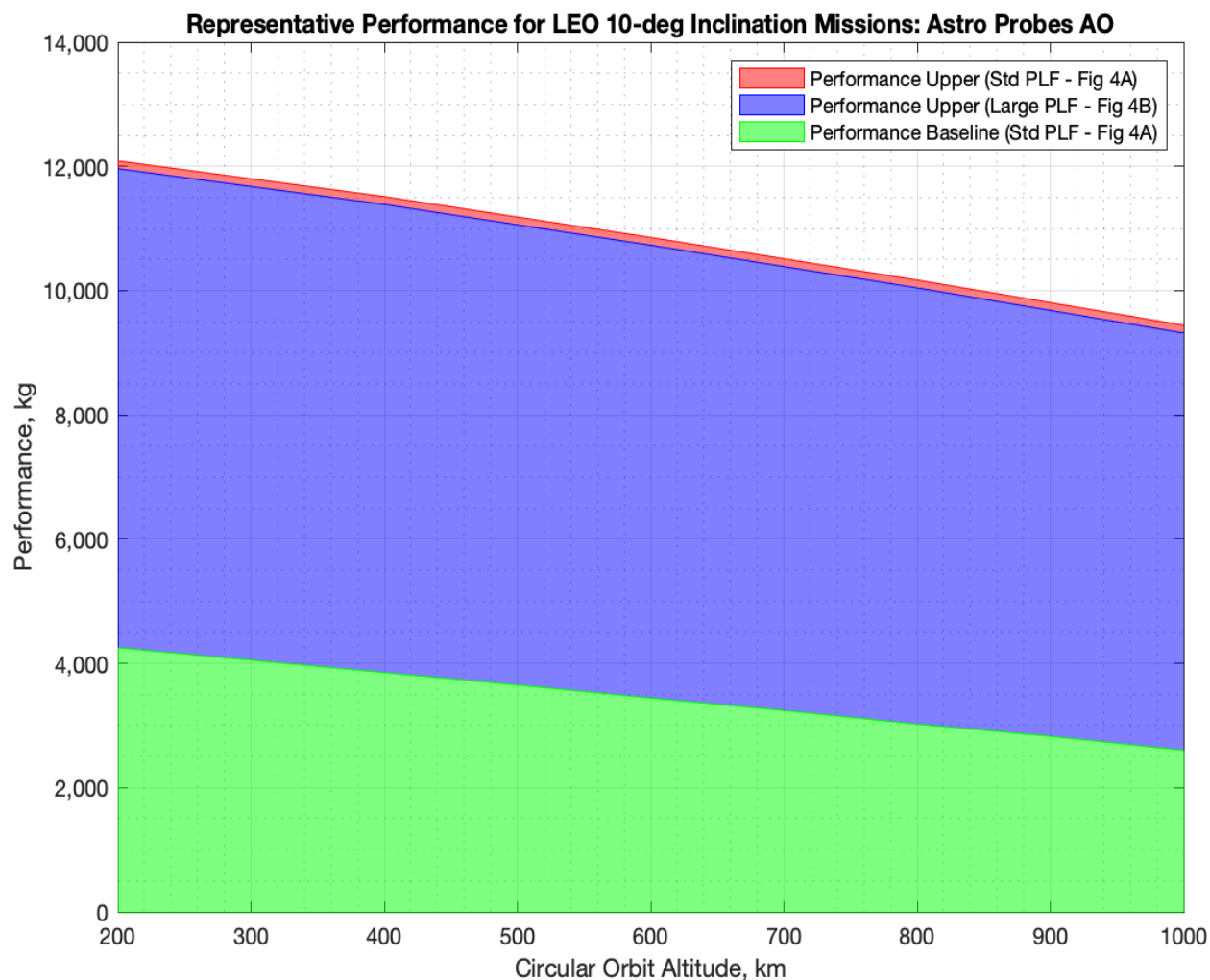


Figure 3A: Constraining LEO 10-deg Inclination Performance Curves

Altitude, km	Baseline	Upper (Standard Fairing)	Upper (Larger Fairing)
200	4250 kg	12085 kg	11960 kg
600	3440 kg	10855 kg	10730 kg
1000	2600 kg	9440 kg	9315 kg

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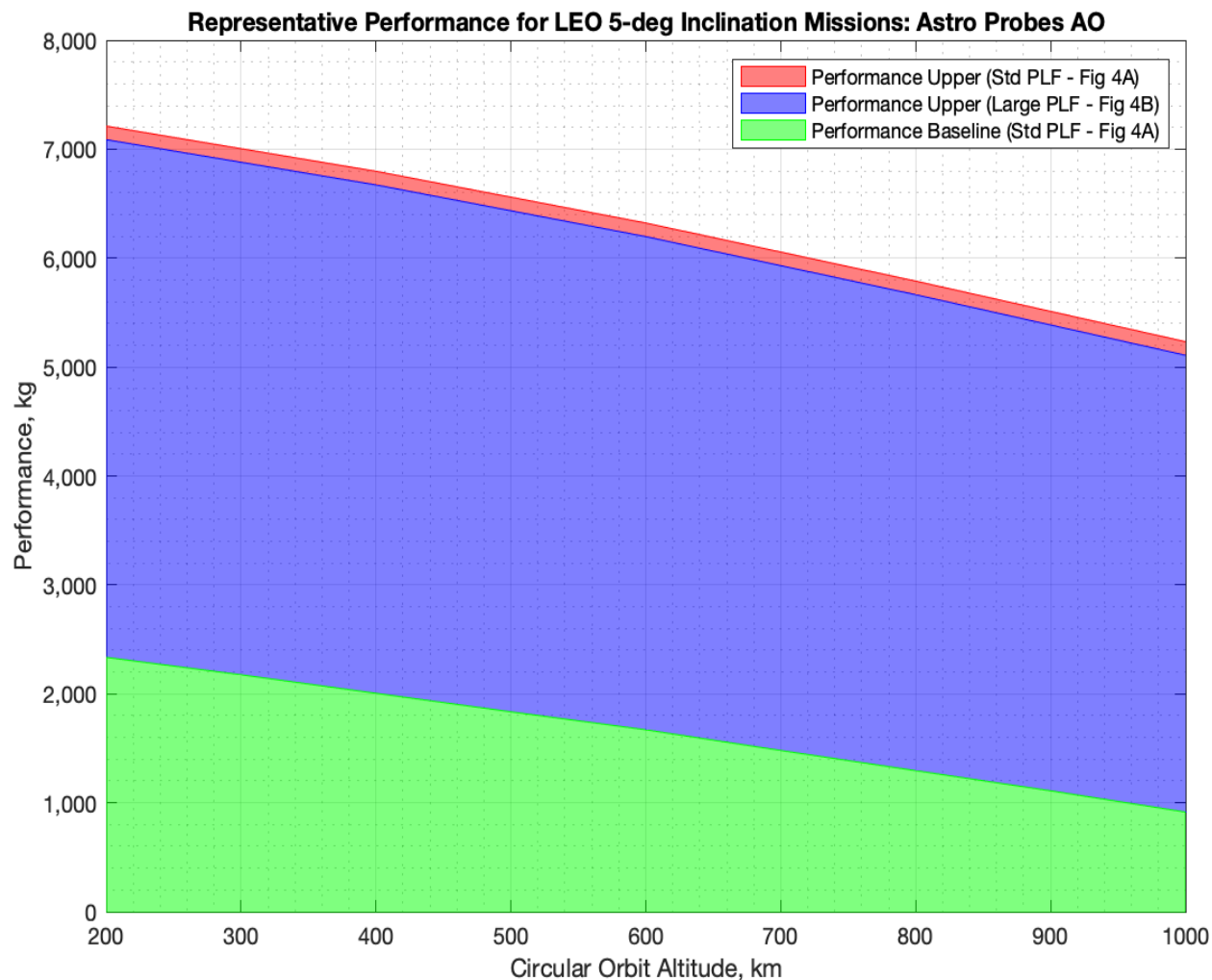


Figure 3B: Constraining LEO 5-deg Inclination Performance Curves

Altitude, km	Baseline	Upper (Standard Fairing)	Upper (Larger Fairing)
200	2335 kg	7210 kg	7085 kg
600	1670 kg	6320 kg	6195 kg
1000	915 kg	5230 kg	5105 kg

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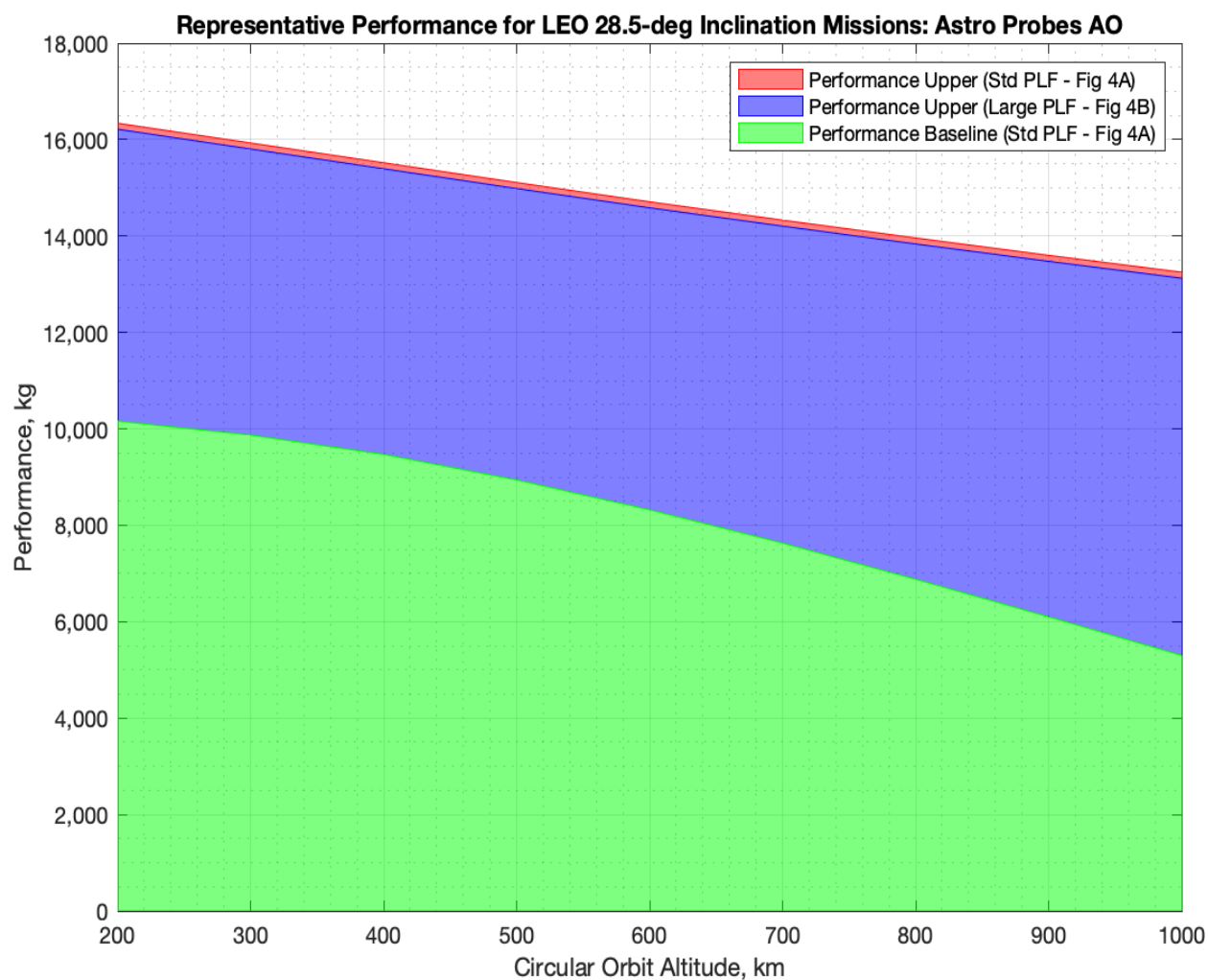


Figure 3C: Constraining LEO 28.5-deg Inclination Performance Curves

Altitude, km	Baseline	Upper (Standard Fairing)	Upper (Larger Fairing)
200	10160 kg	16340 kg	16215 kg
600	8320 kg	14710 kg	14585 kg
1000	5300 kg	13250 kg	13125 kg

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Payload Envelope:

Figures 4A and 4B show the constraining static payload fairing envelopes that will enable compatibility with potential launch vehicle configurations projected to meet the performance capabilities shown in Figures 1-3.

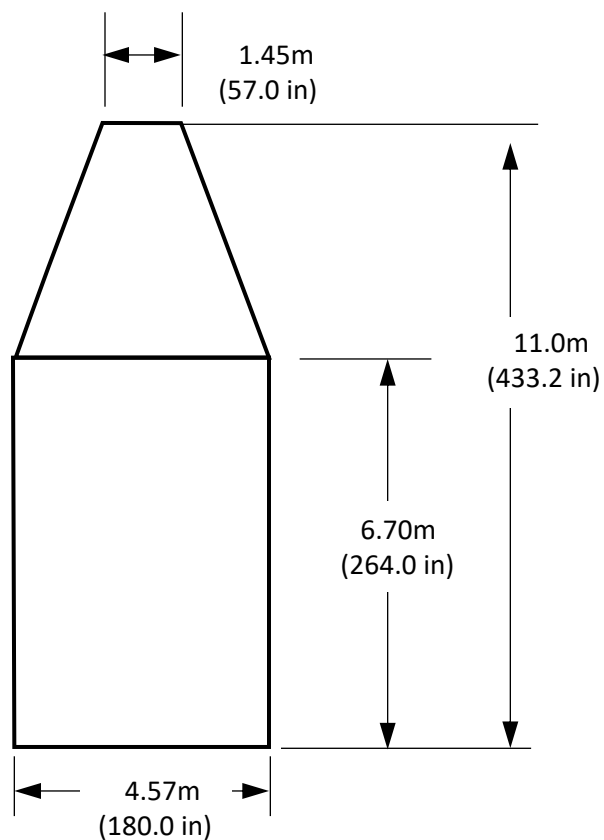


Figure 4A: Standard Fairing Static Envelope Dimensions

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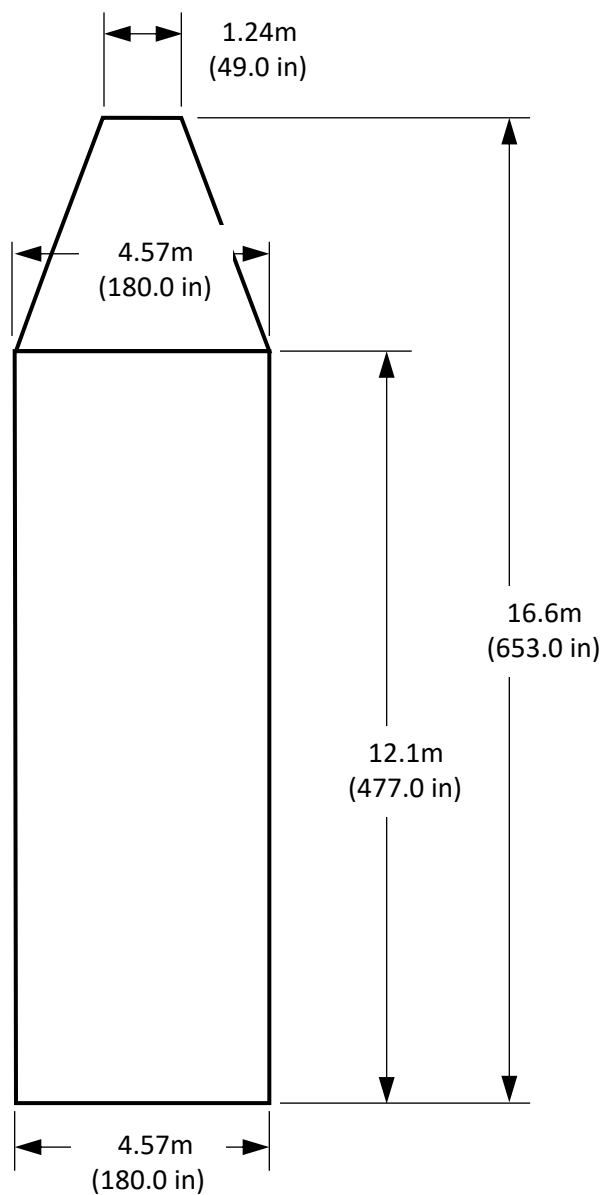


Figure 4B: Larger Volume Fairing Static Envelope Dimensions
(Requires Performance Upper Launch Vehicle)

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Launch Vehicle Enveloping Environments

CG Load Factors

Envelope	
Lateral (g's)	Axial (g's)
2	8.5
2	4
3	4
3	-1.5
2	-1.5
2	-4
-2	-4
-2	-1.5
-3	-1.5
-3	4
-2	4
-2	8.5
2	8.5

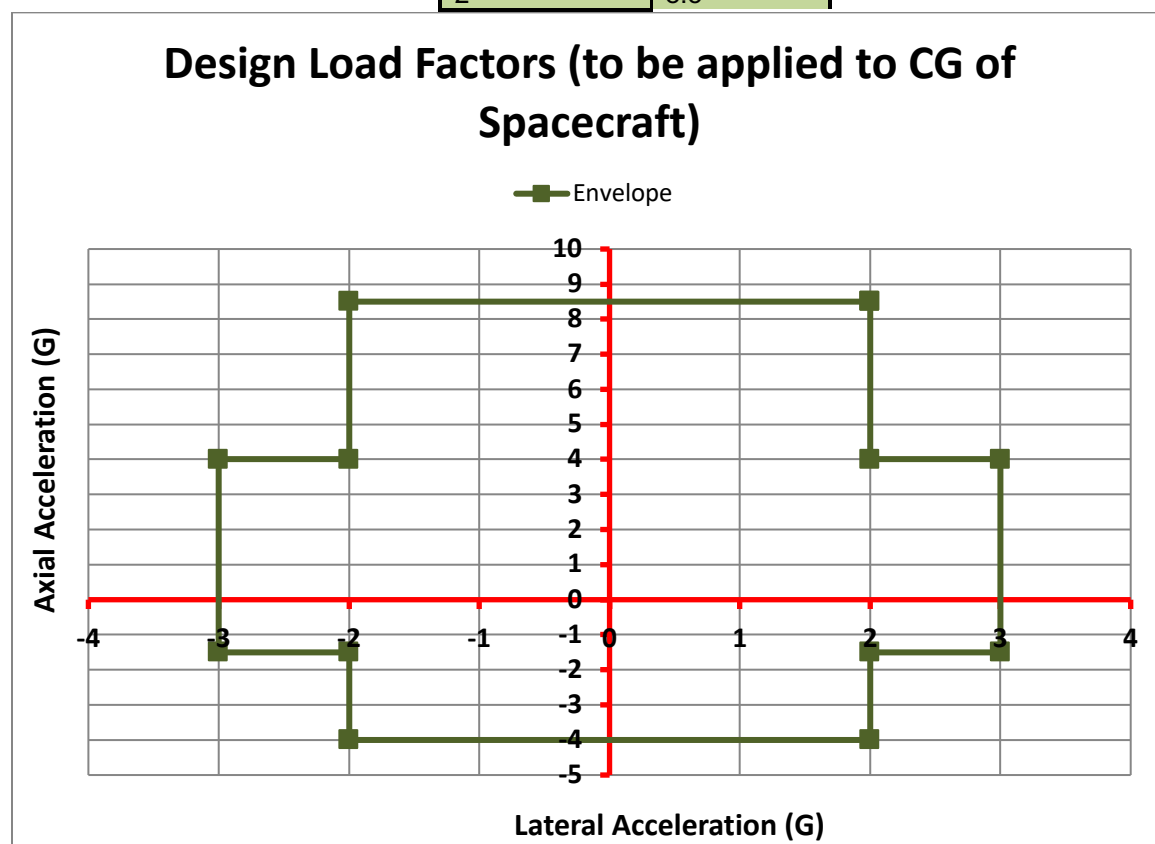


Figure 5.1: Design Load Factors (to be applied to CG of Spacecraft)

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Equivalent Sine Environment:

Envelope			
Frequency (Hz)	Axial (g)	Frequency (Hz)	Lateral (g)
2	1	2	0.8
50	1	25	0.8
50	0.8	25	0.6
82	0.8	100	0.6
85	0.9		
100	0.9		

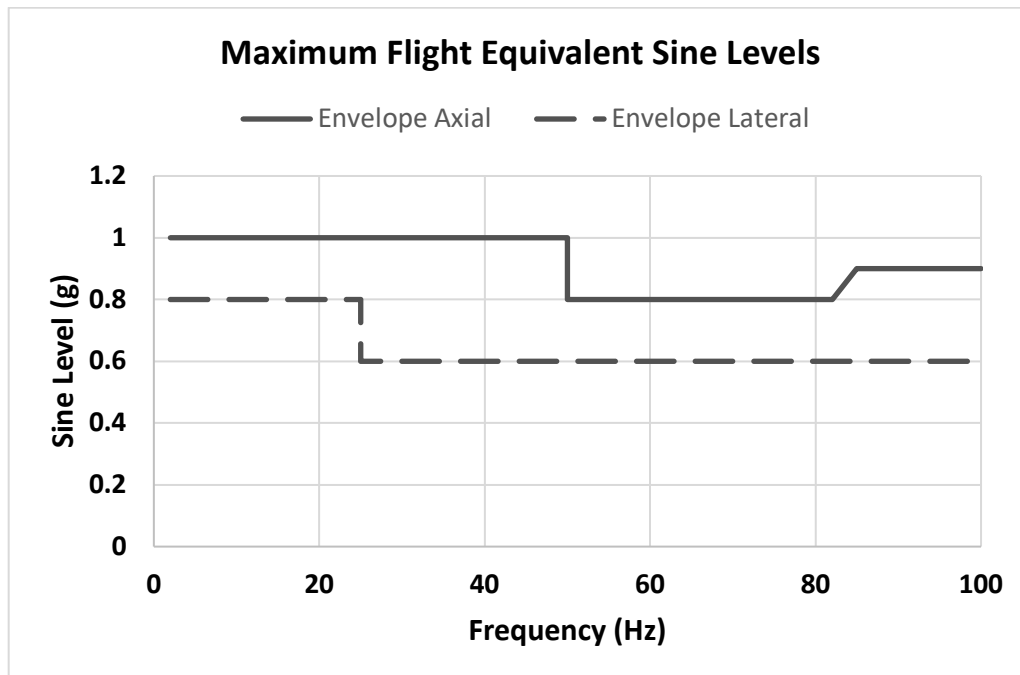


Figure 5.2: Equivalent Sine MPE Level at Spacecraft Interface

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Random Vibration Environment:

Candidate LV Random Vibration Design Envelope (P95/50 MPE)	
Frequency [Hz]	PSD [G^2/Hz]
20	0.0044
100	0.0044
300	0.01
700	0.01
800	0.03
925	0.03
2000	0.00644
Grms	5.13

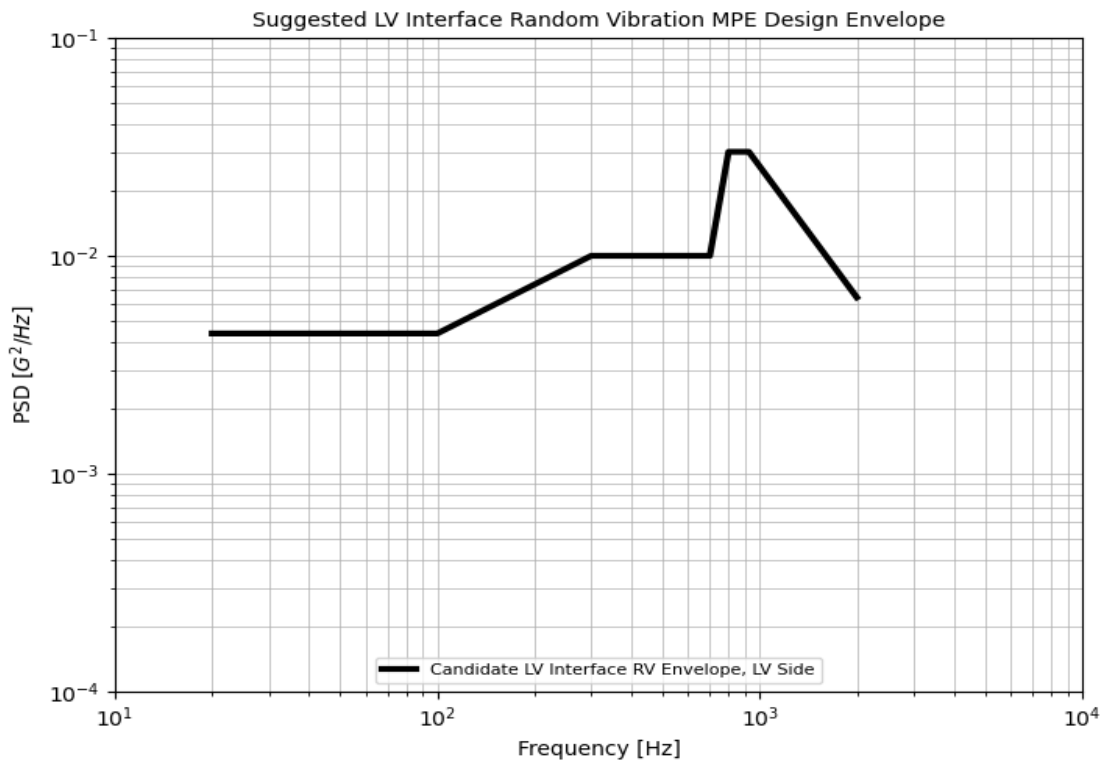


Figure 5.3 Random MPE Levels at Spacecraft Interface

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Acoustic Environment:

Candidate LV Payload Acoustics Design Envelope (P95/50 MPE)	
Frequency [Hz]	SPL [dB]
25	120
31.5	125
40	126.5
50	127
63	127.5
80	128.3
100	130
125	131
160	131
200	131
250	130
315	128
400	126
500	124
630	122
800	119.5
1000	117.8
1250	116.4
1600	115
2000	113.6
2500	112.3
3150	110.9
4000	109.5
5000	108.1
6300	106.8
8000	105.4
10000	104
OASPL	140.1

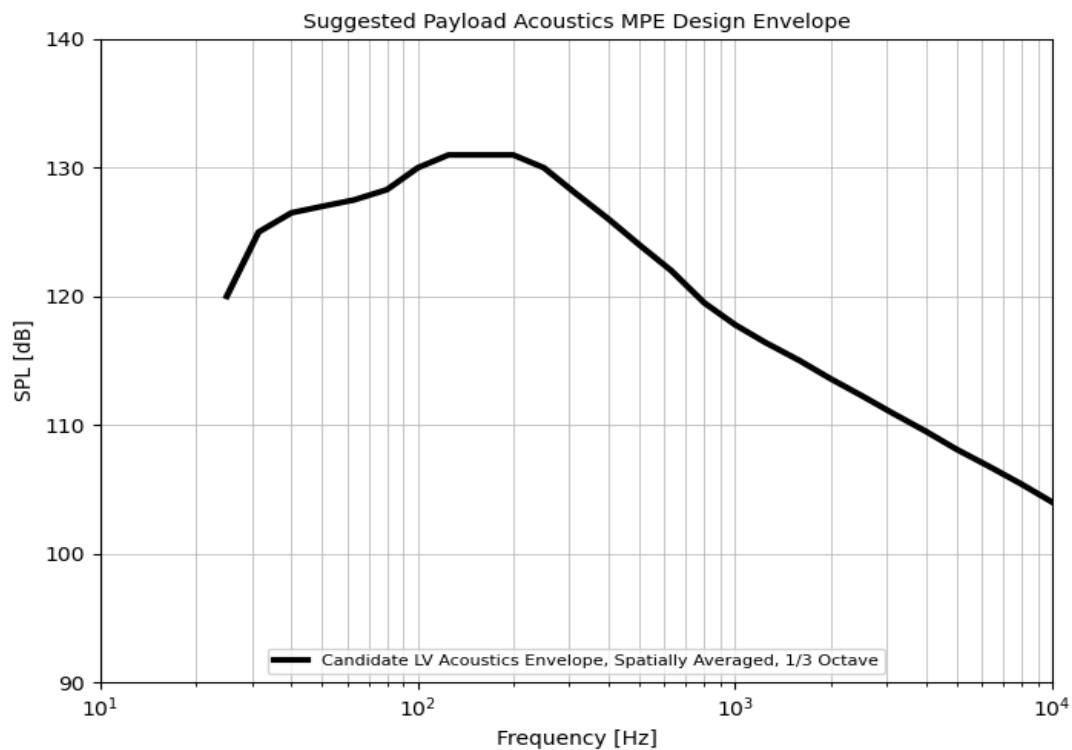


Figure 5.4 Payload Acoustic Levels

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Shock Environment:

Candidate LV Separation Shock Design Envelope (P95/50 MPE)	
Frequency [Hz]	SRS [G-peak]
100	74
1000	2000
10000	2000

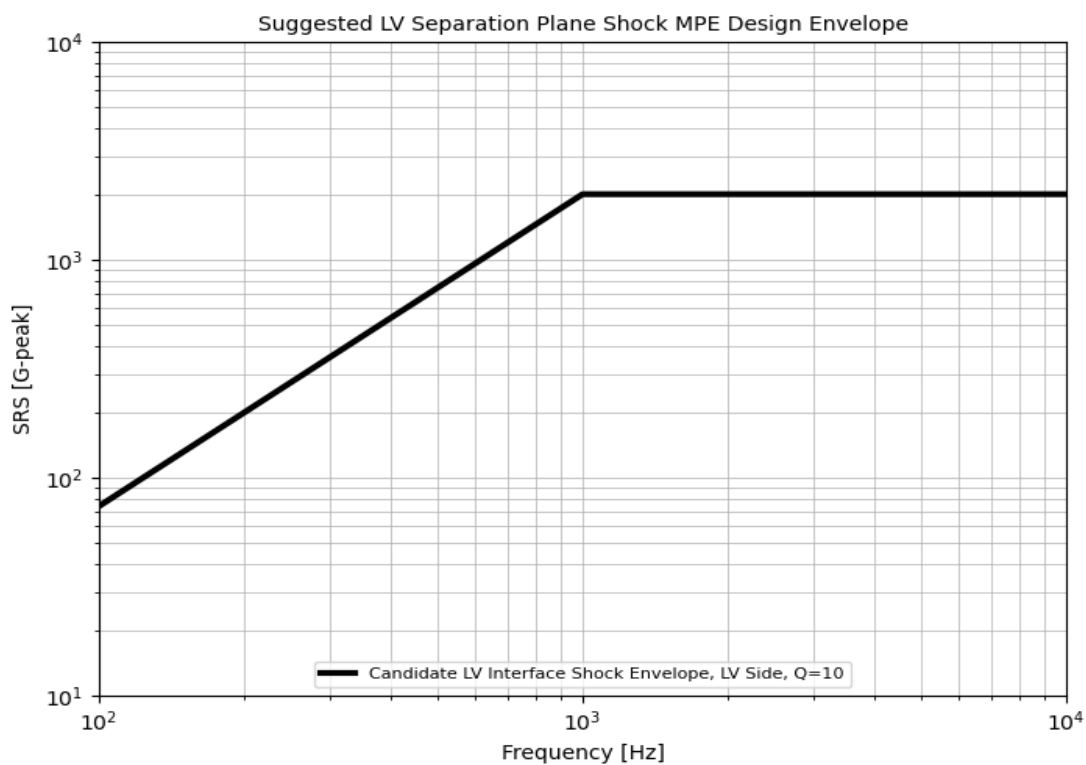


Figure 5.5: Shock MPE Levels at Spacecraft Interface

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**Attachment 2
NASA-LSP Standard Launch Services**

This list provides an overview of the standard and mission-specific services that the spacecraft customer receives with the NASA-LSP **Baseline** launch service for this AO. If additional services are required but not listed herein, or for any questions, please contact the NASA LSP POC listed in this document.

Integrated Services:

- Range support and services
- Payload processing facility and support
- Contractor Engineering support
- Base Support contractors and logistics
- Hazardous support

Launch Vehicle:

- Launch vehicle that meets customer's performance needs
- Payload Fairing with approximately 2 access doors in standard locations, with thermal and/or acoustic blankets
- Standard 1194mm (47in) LV-provided clampband Payload Separation System
- Standard Payload Adapter
- Standard Test Payload adapter availability
- Spacecraft Spin/De-spin capability for separation (if required)
- Single-Spacecraft Collision/Contamination Avoidance Maneuver (CCAM) capability if needed
- Electrical interface connectors (approximately 3 sets)
- Mission-Unique Reviews (approximately 3)
- Readiness Reviews (approximately 4)
- Risk Management
- Launch Vehicle insight and approval per NPD 8610.23
- Mission integration management & engineering support
- Launch campaign management
- Down range telemetry assets for LV data

Baseline Mission-Unique Services

- Mission-Unique payload isolation system
- T-0 Grade B GN2 or pure air Purge
- ISO 14644-1 Class 7 (Class 10K) integration environment
- Pre-ATP studies such as coupled loads and/or trajectories analysis

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**Attachment 3
Risk Assessment/Evaluation Form**

Proposal Name: _____

Proposal #: _____

Evaluator POC: _____

Phone: _____

Email: _____

Launch Service Risk Evaluation:

Overall Assessment: - Given the ground rules in the AO, is the proposed launch vehicle (LV) concept feasible for this application? (☐Yes or ☐No)

Areas of Risk: _____

LV Performance: Area of concern (☐Yes or ☐No)

Proposed LV configuration (Baseline or Upper): _____

Proposed Launch Date: _____

Launch Period (MM/DD/YYYY to MM/DD/YYYY): ____/____/____ to ____/____/____

Launch Window (On any given day of the launch period Minutes:Seconds): ____ : ____

Orbit requirements: Apogee: _____ km Perigee: _____ km Inclination: _____ deg.

High Energy requirements: C3: _____ km²/sec² DLA: _____ deg RLA: _____ deg

CBE Mass (including reserves) Dry Mass: _____ kg Wet Mass: _____ kg

NTE Mass (including reserves) Dry Mass: _____ kg Wet Mass: _____ kg

Dry Mass Margin: _____ kg _____ %

Wet Mass Margin _____ kg _____ %

Formulas:

Mass Margin kg = LV Performance – S/C Mass (including reserves)

Mass Margin % = [(Mass Margin kg) / S/C Mass (including reserves) kg] X 100

LV Performance Comments/issues/concerns:

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LV Integration: Area of risk/concern (☐Yes or ☐No)

Does the proposer have experience in LV integration? (☐Yes or ☐No)

LV to Spacecraft Interface: Area of risk/concern (☐Yes or ☐No)

Proposed Payload Fairing (PLF) _____

Spacecraft (S/C) Dimensions: Radial: _____ m Height _____ m

Any excursions outside of the AO Baseline PLF usable *static* volume? (☐Yes or ☐No)

Mechanical Interface:

Standard Adapter: _____ Custom Adaptor: _____

Electrical Interface:

Standard _____ Pin(s) Connector(s): (☐Yes or ☐No)

Mission Unique requirements:

Instrument T-0 GN2 Purge: (☐Yes or ☐No)

T-0 S/C Battery Cooling: (☐Yes or ☐No)

Planetary Protection Requirements: (☐Yes or ☐No)

Contamination Control Requirements: PLF: (☐Yes or ☐No) LV adapter: (☐Yes or ☐No)

Cleanliness Level: _____ other: _____

List of Mission-Unique or Non-Standard Services proposed that are not part of the AO Baseline launch service offered:

Unique Facility Requirements: (☐Yes or ☐No)

Pad: _____

S/C Processing Facility: _____

S/C Environmental Test Plans

Environmental Test Plan/Flow described: (☐Yes or ☐No)

Comments/issues/concerns/risks:

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Launch Service Budget Assessment Summary

Are any additional Mission-Unique or Non-standard Services costs, not included in the AO Baseline service, addressed in the proposal? (☐Yes or ☐No)

If not, list risks: _____

Has additional funding been identified in the PI-Managed Mission Cost (PI-MMC)? (☐Yes or ☐No) If not, list risks: _____

Spacecraft Schedule: Area of concern (☐Yes or ☐No)

Adequate timing of: Launch Service Integration Start Time: ☐Yes or ☐No)

S/C Environmental Test Program: (☐Yes or ☐No)

S/C ship date: (☐Yes or ☐No)

S/C to LV integrated Operations: (☐Yes or ☐No)

Missions with Radiological material Area of risk/concern? (☐Yes or ☐No)

List the Radiological Sources: _____

Are unique facilities required to store/process the Radiological Sources? (☐Yes or ☐No)

Any LV modifications required for additional safety or Launch approval? (☐Yes or ☐No)

Other identified cost, technical schedule risks?: Area of risk? (☐Yes or ☐No)

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